

Claims

- [c1] An apparatus for electrically commoning contact pads disposed on a surface of a substrate, the apparatus comprising:
 - a container for confining a plurality of electrically conductive particles;
 - said electrically conductive particles, each of said electrically conductive particles being in contact with other electrically conductive particles so that said electrically conductive particles are electrically commoned, where at least some of said electrically conductive particles contact said contact pads so that said contact pads are electrically commoned; and
 - means for maintaining said particles in contact with the surface of the substrate and with said contact pads.
- [c2] An apparatus according to claim 1, wherein said substrate comprises electronic circuits electrically connected to said contact pads, whereby the electronic circuits are electrically commoned due to contact between said electrically conductive particles and said contact pads.
- [c3] An apparatus according to claim 2, wherein said contact pads are a first group of contact pads on a first surface

of the substrate, and the substrate further includes a second group of contact pads disposed on a second surface of the substrate, the second group of contact pads not being in contact with said electrically conductive particles.

- [c4] An apparatus according to claim 3, further comprising an electrical test device, connected to at least one pad of the second group of contact pads and connected to said particles, for testing an electronic circuit connected to said pad of the second group of contact pads and at least one pad of the first group of contact pads.
- [c5] An apparatus according to claim 3, wherein said electrically conductive particles cover said first group of contact pads.
- [c6] An apparatus according to claim 3, wherein said electrically conductive particles are substantially spherical in shape and each have a diameter approximately one-third that of a contact pad in the first group of contact pads.
- [c7] An apparatus according to claim 1, wherein each of said electrically conductive particles has a surface of non-oxidizing electrically conductive material.
- [c8] An apparatus according to claim 4, wherein said electrically conductive particles are sufficiently rigid so as to

prevent substantially permanent deformation thereto during testing by said test device.

- [c9] An apparatus according to claim 1, wherein said electrically conductive particles are made from at least one of gold and platinum.
- [c10] An apparatus according to claim 1, wherein said electrically conductive particles have a coating made from at least one of gold and platinum.
- [c11] An apparatus according to claim 4, wherein said electrical test device includes means for sequentially contacting separate pads of the second group of contact pads during testing by said test device.
- [c12] An apparatus according to claim 11, wherein said electrical test device tests the electronic circuits to detect open circuits.
- [c13] An apparatus according to claim 1, wherein said means for maintaining said particles in contact with the surface of the substrate comprises means for causing motion of the particles toward the surface of the substrate and said contact pads, thereby maintaining electrical contact between said particles and said contact pads.
- [c14] An apparatus according to claim 13, wherein said motion

is caused by at least one of a shaking mechanism, a magnetic-field mechanism and an ultrasonic mechanism.

- [c15] An apparatus according to claim 1, wherein said container has walls of a flexible material.
- [c16] A method for electrically commoning contact pads located on a first surface of a substrate wherein each pad is connected to a circuit supported by said substrate, the method comprising the steps of:
 - providing a container for confining electrically conductive particles;
 - providing a supply of electrically conductive particles in said container;
 - placing and holding the substrate in said container such that the pads contact said particles; and
 - maintaining said particles in contact with other said particles and with said pads, whereby said pads are electrically commoned.
- [c17] A method according to claim 16, further comprising the step of removing contaminant from the surface of the substrate and from the first group of contact pads prior to said step of placing and holding the substrate within said container.
- [c18] A method according to claim 16, wherein the contact

pads on the first surface of the substrate are a first group of contact pads, and the substrate includes a second group of contact pads located on a second surface of the substrate, each of the second group of pads being connected to one of the circuits, and said method further comprises the step of: contacting at least one of the second group of contact pads and said particles with a test device for testing a circuit connected between at least one pad of the second group of contact pads and at least one pad of the first group of contact pads.

- [c19] A method according to claim 18, wherein contacting step further comprises sequentially contacting separate pads of the second group of contact pads during testing by said test device.
- [c20] A method according to claim 18, further comprising the step of:
maintaining said particles in contact with the surface of said substrate by causing motion of the particles toward the surface of the substrate and the first group of contact pads, thereby maintaining electrical contact between said particles and the first group of contact pads.